

This skills unit contains:

- an approach to problem solving
- problem solving strategies

**Problem solving** occurs in all areas of your life and particularly at work. It need not be a 'hit and miss' activity.



*It helps if you can develop an approach to solving problems that can be used in most situations.*



**Some steps to problem solving:**

- 1 ***understand*** the problem
- 2 ***decide*** what maths you will do
- 3 ***estimate*** an answer
- 4 ***do*** the maths
- 5 ***check*** your answer

Now, let's go through this problem solving approach in detail:

### Step 1 Understand the problem

**It sometimes helps to put the problem in a different form so you can understand it better.**



#### **You could:**

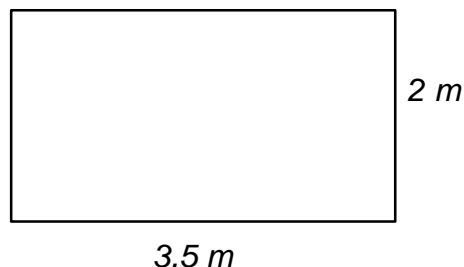
- write the information **in your own words**
- **draw** a diagram or picture
- **talk** with someone about the problem
- **organise** the information into a table or chart

Example:

#### ***The Problem:***

*Find the cost of tiles, priced at \$21.80 a square metre ( $m^2$ ), to tile the floor of a kitchen that is 3.5 m long by 2 m wide.*

*A diagram is useful for picturing the information:*

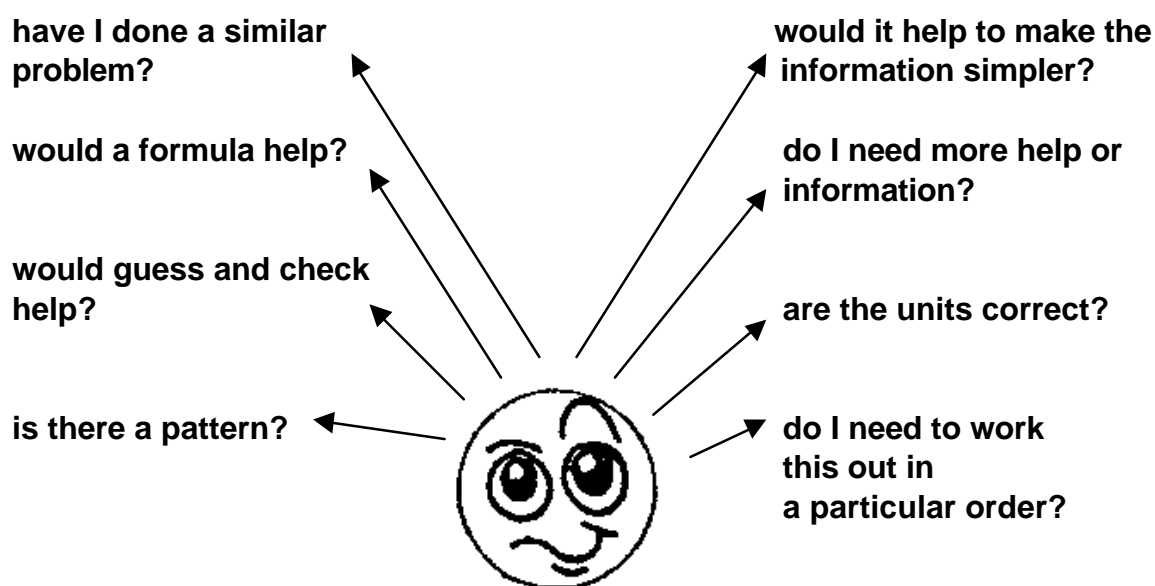


*Other information: 1  $m^2$  of tiles costs \$21.80*

**Step 2**    **Decide what maths you will do**

This step asks you to **decide what maths you will do and how you will do it**. Most people find that this is the most difficult part of problem solving.

You could develop a mindmap of your thoughts!



Example (continued):

Perhaps **your thinking** might go like this:

To find the cost of tiles you need to find the number of square metres ( $m^2$ ) of tiles required, ie. you need the floor area of the kitchen in  $m^2$ .

You know the floor is rectangular but what do you know about the area of a rectangular shape?

Area of a rectangle = length x width  
(length and width must be in the same units)

So you need to calculate area first.

Then calculate cost by multiplying area by cost per  $m^2$ .

This could be your plan for solving the problem!

### Step 3 Estimate an answer

**An estimate is a rough answer; it may be a guess.** It is used as a check on your calculated answer. Your estimate will depend on your arithmetic and estimating skills!

*it's a rough answer – don't spend time getting it accurate*

What is an estimate? ——— it can mean you will need to use your

- *maths knowledge*
- maths understanding*
- rounding skills*
- short-cut calculation*

Example (continued):

***Most of this will happen in your head:***

*Round 3.5 m to 4 m and \$21.80 to \$20 to make your estimate calculation easier.*

*Estimate of area =  $4\text{ m} \times 2\text{ m} = 8\text{ m}^2$  (this estimate will be more than the actual area as 4m is more than 3.5 m)*

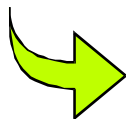
*Estimate of cost =  $8\text{ m}^2 \times \$20\text{ per square metre} = \$160$   
(this will probably be more than the actual cost)*

*The cost estimate is the only detail noted down (for later comparison with actual cost).*

**Step 4 Do the maths**

*Do you have a plan  
for doing the maths?*

It may be a good idea to write your working down just in case you need to repeat this step!

**Remember!**

- \* **units of quantities involved need to be consistent** - eg. all lengths in the same unit, all in metres or millimetres
- \* **the order of doing a calculation may be important**
- \* be sure that you **read a formula correctly**  
eg.  $2r$  and  $r^2$  do not mean the same thing

Example (continued):

Now **do the actual calculation** as planned in Step 2:

$$\begin{aligned}\text{Floor area} &= \text{length} \times \text{width} \\ &= 3.5 \text{ m} \times 2 \text{ m} \\ &= 7.0 \text{ m}^2\end{aligned}$$

$$\text{Cost of tiles} = 7.0 \text{ m}^2 \times \$21.80 = \$152.60$$

**Step 5** Check your answer

Ask yourself some questions about your answer.

- does it seem **reasonable**?
- is it what you **expected**?
- how does your answer compare to your **estimate**? do they **agree or disagree**?
- do you need to **add a unit** to your answer?  
eg. is it in kg or m?

If your answer isn't what you expected it to be, you may need to repeat the earlier steps and check that each of them fits the problem.



**This last step is very important - it asks you to think about and learn from your problem solving experience.**

Questioning and reviewing your strategies will help you develop your problem solving skills.

Practise these problem solving steps whenever you can. You could find that problem solving is an easy, enjoyable activity!

Example (continued):

*Your calculated answer of \$152.60 agrees closely with your estimate of \$160.*

*This seems to be a reasonable solution to the problem.*

*The \$ sign has been added as the answer is a cost amount.*



### Activity 1

*You are going shopping for three electrical items you have seen advertised at Harry's Hardware. They are a kettle for \$35.70, an iron for \$42.80 and a sandwich toaster for \$28.90. You also want to buy lunch for about \$8 while you shop. How much money should you take with you?*

#### Step 1 Understand the problem

*You expect to spend:*

|                |                 |
|----------------|-----------------|
| <i>Kettle</i>  | <i>\$</i> _____ |
| <i>Iron</i>    | <i>\$</i> _____ |
| <i>Toaster</i> | <i>\$</i> _____ |
| <i>Lunch</i>   | <i>\$</i> _____ |

*Amount to cover purchases?*

#### Step 2 Decide what maths you will do

*You need to* \_\_\_\_\_

#### Step 3 Estimate the answer

*Rounding each price gives:*      $\$40 + \text{_____} + \text{_____} + \text{_____} = \text{_____}$  *total*

*For a problem like this, the estimated cost might be the answer you want!*

#### Step 4 Do the maths

*Total cost =*  $\$35.70 + \$42.80 + \$28.90 + \$8 = \$$ \_\_\_\_\_

#### Step 5 Check the answer

*How does your answer compare to the estimate?*

*Would your estimate have left you short on cash to pay for the items?*

*What advantage does an estimate have in this type of situation?*

### **Activity 1 Answers**

#### **Step 1**

|                            |                |                |
|----------------------------|----------------|----------------|
| <i>You expect to spend</i> | <i>Kettle</i>  | <i>\$35.70</i> |
|                            | <i>Iron</i>    | <i>\$42.80</i> |
|                            | <i>Toaster</i> | <i>\$28.90</i> |
|                            | <i>Lunch</i>   | <i>\$8.00</i>  |

*Amount to cover purchases?*

#### **Step 2**

*You need to add up the four amounts.*

#### **Step 3**

*$\$40 + \$40 + \$30 + \$10 = \$120$  total*

#### **Step 4**

*\$115.40*

#### **Step 5**

*Calculated answer agrees reasonably well with the estimate. Since 3 out of 4 items were rounded up, the estimate is greater than the calculated answer and would leave you with a little extra cash!*

*Estimate is quick and easy.*



**Activity 2**

*You have to wait 8 days for a leaking pipe to be repaired. In 1 hour the pipe loses 4 litres of water. How much water will be lost while you wait for it to be repaired?*

**Step 1 Understand the problem**

*Note the key information:*

**Step 2 Decide what maths you will do**

*First calculate \_\_\_\_\_*

*then \_\_\_\_\_*

**Step 3 Estimate an answer**

*Use your plan from Step 2 but remember to use rounded figures for an estimate*

**Step 4 Do the maths**

*Look back to your step 2 plan but this time use accurate figures:*

**Step 5 Check your answer**

*Do your estimate and answer agree?*

*Does your answer look reasonable to you?*

*Have you added a unit to your answer?*

*Do you think you would take some action if it were actually you in this situation?*

**Activity 2 Answers**

Your thinking may have gone like this:

**Step 1**

*4 L in 1 hr*

*? L in 8 days*

*(24 hrs in 1 day)*

**Step 2**

*4 x 24 (water loss in 1 day)*

*multiply by 8 to give loss in 8 days*

**Step 3**

*5 x 20 = 100 L in 1 day*

*8 x 100 = 800 L in 8 days*

**Step 4**

*Water loss in 1 day = 4 x 24 = 96 L*

*Water loss in 8 days = 8 x 96 = 768 L*

**Step 5**

*The estimate and answer are close enough.*

*The answer is reasonable.*

*The answer is in L.*

*Probably try another repairer!*

**Activity 3**

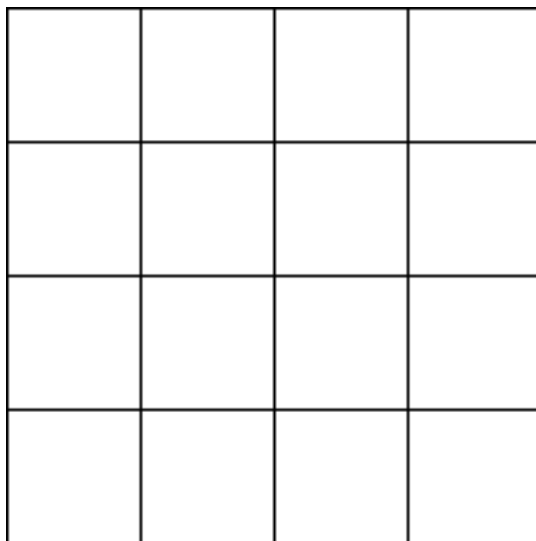
*Slate floor tiles are 25 cm square. How many tiles are needed to tile an entrance area that is rectangular and 2.8 m long by 1.7 m wide?*

**Step 1 Understand the problem**

*You might draw a diagram of the floor area:*

*Each tile is \_\_\_\_\_ square.*

*What does a square metre of tiles look like? How many tiles in 1 m<sup>2</sup>?*



$$4 \times 25 \text{ cm} = 1 \text{ m}$$

$$4 \times 25 \text{ cm} = 1 \text{ m}$$

**Step 2 Decide what maths you will do**

*You need the number of tiles in a square metre*

*Then* \_\_\_\_\_

*and* \_\_\_\_\_

**Step 3 Estimate the answer**

Round floor dimensions: 2.8 m to \_\_\_\_ m and 1.7 m to \_\_\_\_ m

Estimate of floor area = \_\_\_\_ x \_\_\_\_ = \_\_\_\_ m<sup>2</sup>

Estimated no. of tiles = \_\_\_\_ tiles for 1 m<sup>2</sup> of area

Estimate of tiles needed for floor area = \_\_\_\_ tiles

**Step 4 Do the maths**

Repeat Step 3 but **use exact, not rounded amounts**, and a calculator not short-cut arithmetic:

Number of tiles for each m<sup>2</sup> of floor space = \_\_\_\_ (from picture in Step 1)

Floor Area = \_\_\_\_ x \_\_\_\_ = \_\_\_\_ m<sup>2</sup>

No. of tiles = \_\_\_\_ m<sup>2</sup> x \_\_\_\_ tiles per m<sup>2</sup> = \_\_\_\_ tiles

**Step 5 Check the answer**

Do the answer and estimate agree fairly well?

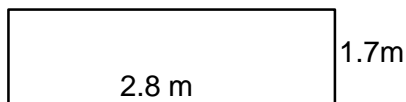
Is the answer reasonable for the problem?

Do you need to check your answer?

Would you allow extra tiles for breakages, cutting, etc.? How many more would you buy?

**Activity 3 Answers**

Your thinking may have gone like this:

**Step 1**

*Each tile is 25 cm square. 16 tiles in  $1\text{m}^2$*

**Step 2**

*Then find the area of the entrance in  $\text{m}^2$   
(area of rectangle = length x width)  
and multiply this area by 16*

**Step 3**

*3 m, 2 m*

$$3\text{ m} \times 2\text{ m} = 6\text{ m}^2$$

*20 tiles in  $1\text{ m}^2$*

$$20 \times 6 = 120\text{ tiles}$$

**Step 4**

*16 tiles*

$$2.8\text{ m} \times 1.7\text{ m} = 4.76\text{ m}^2$$

$$4.76 \times 16 = 76.16\text{ tiles}$$

**Step 5**

*The estimate and answer are not close. Check your answer. The estimate is high because we rounded 16 up to 20 tiles.*

*The answer of 76.16 needs to be rounded up to 77 tiles.*

*You would probably allow an extra 8 to 10 tiles depending on how they were to be laid.*